Having thus described the preferred embodiments, the invention is now claimed to be:

1. An MRI system comprising:

a means **(34)** for creating and transmitting RF pulses into an examination region **(14)** to excite and manipulate a spin system to be imaged;

a means **(20, 24, 28)** for picking up an MR signal emitted from the examination region **(14)**;

a means **(36)** for demodulating the MR signal and converting the demodulated MR signal into digital data; and

a means **(40)** for reconstructing images from the digital data, which includes:

a plurality of processing units **(52)**, which include dynamically reconfigurable connections **(56)**.

2. The MRI system as set forth in claim 1, wherein the plurality of processing units **(52)** includes embedded processors.

3. The MRI system as set forth in claim 1, wherein the plurality of processing units **(52)** includes one of personal computers and workstations.

4. The MRI system as set forth in claim 1, wherein the processing units **(52)** are dynamically reconfigured utilizing a switched fabric, a crossbar **(60)** or the like.

5. The MRI system as set forth in claim 1, wherein the means **(20, 24, 28)** for picking up the MR signal includes a plurality of coil elements and the means **(36)** for demodulating and converting the MR signal includes a plurality of RF receivers **(36_1, 36_2, ..., 36_n)**, each operatively connected to an associated coil element, and further including:

a means **(60)** for interconnecting the processing units **(52)** to arrange the processing units **(52)** into a plurality of independent parallel processing channels **(42_1, 42_2, ..., 42_n)**, each channel being operatively connected with one or more RF receivers **(36_1, 36_2, ..., 36_n)**.

6. The MRI system as set forth in claim 5, wherein each of the independent parallel processing channels **(42_1, 42_2, ..., 42_n)** further include:

one or more pipeline stages **(54_1, 54_2, ..., 54_m)**.

7. The MRI system as set forth in claim 6, wherein each of the independent parallel processing channels **(42_1, 42_2, ..., 42_n)** further include:

a first pipeline stage **(54_1)** to operate on the digital data in k-space;

one or more intermediate pipeline stages **(54_2, 54_3)** to transform the digital data from k-space to an image domain; and

a final pipeline stage **(54_4)** to operate on the digital data in the image domain.

8. The MRI system as set forth in claim 6, further including:

a combining unit **(44)**, operatively connected to the processing units **(52)** allocated to a final pipeline stage **(54_m)**, to manipulate outputs of each channel.

9. The MRI system as set forth in claim 8, wherein the combining unit **(44)** weights the output of each channel and sums the weighted outputs.

10. The MRI system as set forth in claim 8, wherein an exchange of the data generated by the independent processing channels **(42_1, 42_2, ..., 42_n)** is restricted to an image domain and further includes:

one of the exchange of the data via the processing units **(52)** allocated to the final pipeline stage **(54_m)** and via the combining unit **(44)**.

11. A method for processing an MR signal comprising:

creating and transmitting RF pulses into an examination region (14) to excite and manipulate a spin system to be imaged;

picking up the MR signal emitted from the examination region (14);

demodulating the picked up MR signal and converting the demodulated MR signal into digital data; and

reconstructing images from the digital data via a plurality of processing units (52), which include dynamically reconfigurable connections (56).

12. The method as set forth in claim 11, further including:

dynamically reconfiguring the processing units connections (56) to allocate the processing units (52) to processing channels (42_1, 42_2, ..., 42_n) and pipeline stages (54_1, 54_2, ..., 54_m) on a per scan basis.

13. The method as set forth in claim 12, further including:

dynamically allotting the processing channels (42_1, 42_2, ..., 42_n) to RF receivers (36_1, ..., 36_n) in use.

14. The method as set forth in claim 11, further including:

interconnecting the processing units (52) to arrange the processing units (52) into a plurality of independent parallel processing channels (42_1, 42_2, ..., 42_n), each channel being operatively connected with one or more RF receivers (36_1, 36_2, ..., 36_n); and

reconstructing the images from the digital data via independent processing in each independent processing channel.

15. The method as set forth in claim 14, wherein the processing units (52) in each independent parallel processing channel are arranged into a plurality of pipeline stages (54_1, 54_2, ..., 54_m).

16. The method as set forth in claim 15, further including:

weighing an output of each processing channel; and

one of partial and complete combining of the weighed outputs.

17. The method as set forth in claim 16, wherein the combining is performed in a final pipeline stage **(54_m)** and includes:

combining an image from a first channel **(42_1)** with an image from an adjacent channel **(42_2)** to form a first intermediate combined image, and combining an image from a channel n **(42_n)** with an image from an adjacent channel **(42_{n-1})** to form a second intermediate combined image; and

combining each intermediate combined image with an image from another channel to generate new intermediate combined images until images from all channels have been combined into a resultant combined image.

18. The method as set forth in claim 17, further including:

distributing the resultant combined image to the processing units **(52)** allocated to the final pipeline stage **(54_m)** by consecutively forwarding the resultant combined image from the middle channel **($42_{n/2}$)** in direction of the last channel **(42_n)** and simultaneously forwarding the resultant combined image in opposite directions from the middle channel **($42_{n/2}$)** in direction of the last channel **(42_n)** via adjacent processing units.

19. The method as set forth in claim 16, wherein the combining is performed in a final pipeline stage **(54_m)** and includes:

combining images from pairs of processing channels into intermediate combined images; and

combining pairs of the intermediate combined images until images from all channels have been combined into a resultant combined image.

20. The method as set forth in claim 19, further including:

distributing the resultant combined image to the processing units **(52)** allocated to the final pipeline stage **(54_m)** by consecutively forwarding the resultant combined image from the middle channel **($42_{n/2}$)** to the last channel **(42_n)** and simultaneously forwarding the resultant combined image in opposite directions from the middle channel **($42_{n/2}$)** to the last channel **(42_n)** via adjacent processing units.

21. The method as set forth in claim 14, further including:

mapping a forward processing of iterative reconstruction algorithms to the pipeline stages (54_1, 54_2, ..., 54_m);

mapping a backward processing of the iterative reconstruction algorithms to the pipeline stages (54_m, 54_{m-1}, ..., 54_1); and

simultaneously performing the forward and backward processing of different data sets, such that:

a first pipeline stage (54_1) operates on the digital data in k-space, and

a final pipeline stage (54_m) operates on the digital data in an image domain.

22. The method as set forth in claim 21, further including:

utilizing two separate independent parallel processing channels for the forward and backward processing of iterative reconstruction algorithms.